

Precalculus

Function Representations & Average Rates | 2-Topic Precalculus Bundle

2-topic bundle | 192 problems | Four activity formats

01 Function Representations and Average Rates of Change

[View individual product and its full preview](#)

02 Comparing Average Rates of Change

[View individual product and its full preview](#)

In every topic

Answer Bank Challenge	24 tasks
Grid Rounds	24 tasks
Match & Move	24 cards
Error Analysis & Strategy	24 tasks
Quick Answer Key and Full Worked Solutions	included
Teacher / Parent Use Guide and Terms of Use	included

Product previews

The following preview pages show the cover, all four activity formats, and worked examples for each included resource, in the listed order.

16 PDFs and 2 READMEs; 182 buyer PDF pages across the 2 products.

Preview pages are not included in the buyer page count. Check the list against resources you already own.

This is a fixed collection of the listed products. Purchase includes the existing individual resource files. To open a product's online preview, follow its title link and select View Preview.

AP Precalculus
Function Representations and Average Rates of Change

Function Representations and Average Rates of Change | APPC-COMB-U01-P01-P02

96 problems · Four activity formats

01	Answer Bank Challenge	24 tasks
02	Grid Rounds	24 tasks
03	Match & Move	24 cards
04	Error Analysis & Strategy	24 tasks
05	Quick Answer Key	96 answers
06	Full Worked Solutions	96 solutions
07	Teacher / Parent Use Guide	included
08	Terms of Use & License	included

Topic focus

Across 96 tasks this topic asks for exact average rate, degrees Celsius per day, kilopascals per hour, function decision with justification, value comparison and behavior statement and labeled qualitative graph.

8 PDFs and a README; 107 buyer pages.

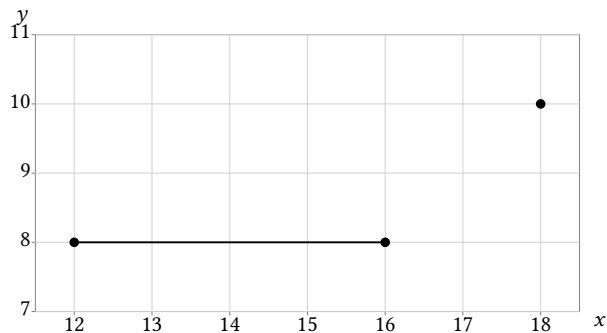
AP Precalculus

Function Representations and Average Rates of Change

Name: _____ Date: _____ Class: _____

Answer each question and record the matching bank letter. Give exact values. A value without its unit is not a complete answer.

An exact graph consists of a line segment from $(12, 8)$ (solid) to $(16, 8)$ (solid); the isolated solid point $(18, 10)$. Find every input satisfying $y = 8$, respecting all endpoint markers.

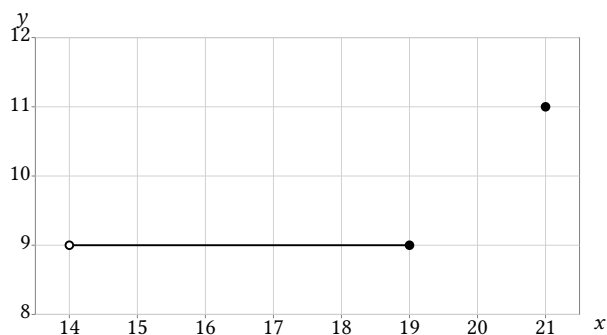


Bank label: _____

For a mixing tank, solution volume is $F(t) = 10 + 3t$ liters after t continuous minutes. Operation may last at most 8 minutes, but capacity is 22 liters. Give the feasible domain and output range.

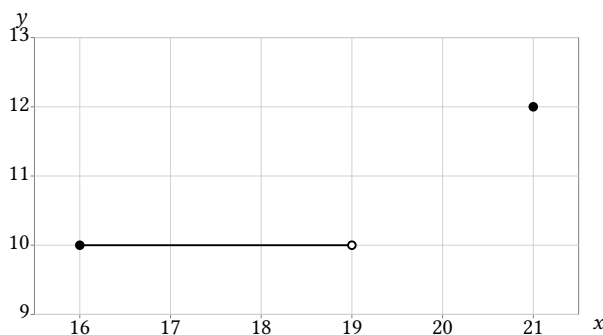
Bank label: _____

An exact graph consists of a line segment from $(14, 9)$ (open) to $(19, 9)$ (solid); the isolated solid point $(21, 11)$. Find every input satisfying $y = 9$, respecting all endpoint markers.



Bank label: _____

An exact graph consists of a line segment from $(16, 10)$ (solid) to $(19, 10)$ (open); the isolated solid point $(21, 12)$. Find every input satisfying $y = 10$, respecting all endpoint markers.



Bank label: _____

AP Precalculus

Function Representations and Average Rates of Change

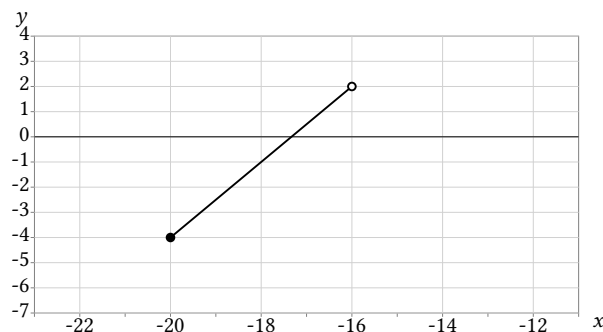
Name: _____ Date: _____ Class: _____

Answer each question and show your reasoning in the workspace. Give exact values rather than decimals unless the question supplies a decimal. A value without its unit is not a complete answer.

A study controls number of concert tickets purchased and records total charge. The model is $f(x) = 4x + 2$, and $f(3) = 14$. Identify the input and output quantities with units, then interpret $f(3) = 14$.

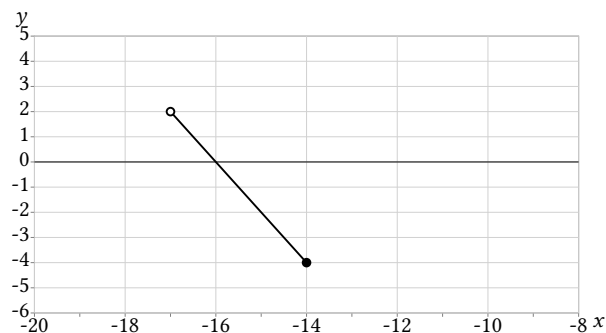
Measure the input in tickets and the total charge in dollars.

An exact graph uses one unit per tick and consists of a line segment from $(-20, -4)$ (solid) to $(-16, 2)$ (open). Determine the domain and range of the plotted relation; do not use the viewing-window edges.



For sealed sample tubes loaded into a rack, rack mass is $F(n) = 7 + 3n$. At most 4 items fit, and n must be a whole number. Give the feasible domain and range.

An exact graph uses one unit per tick and consists of a line segment from $(-17, 2)$ (open) to $(-14, -4)$ (solid). Determine the domain and range of the plotted relation; do not use the viewing-window edges.



AP Precalculus

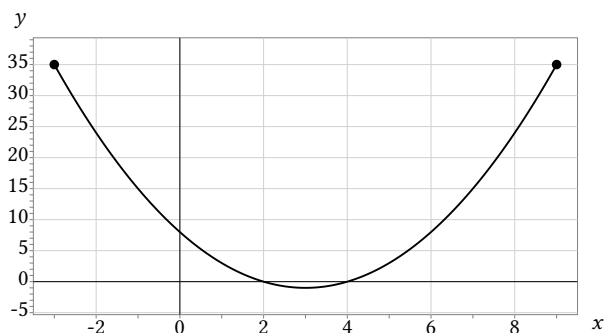
Function Representations and Average Rates of Change

Name: _____ Date: _____ Class: _____

Begin at START. Answer the card, then find the matching final answer at the top of another card. Use the recording sheet for your reasoning. Visit each card once and continue to FINISH.

START

An exact graph consists of the graph of $y = (x - 3)^2 - 1$ for $-3 \leq x \leq 9$, with the left endpoint included and right endpoint included. Find every input satisfying $y = 15$, respecting all endpoint markers.



Your response: _____

Incoming: Rates are $F: 0, T: 5, G: 0$; ranking: $T > F = G$.

A relation is shown by isolated plotted points:

$(29, 18), (30, 23), (32, 18), (34, 25)$. Is the relation a function of the first coordinate? Justify using the input-output condition.

Context/domain: precalculus

29	18
30	23
32	18
34	25

Your response: _____

Incoming: Rates are $F: -1, T: 2, G: 5$; ranking: $G > T > F$.

A finite table gives $x = 3, f(x) = 14$; $x = 6, f(x) = 19$; $x = 9, f(x) = 17$. The function is continuous on the displayed interval, but no interpolation rule is specified. Evaluate the claim: "The maximum output on $[3, 9]$ is 19." State whether it is supported and identify exactly what the evidence does or does not determine.

Context/domain: precalculus

3	14
6	19
9	17

Your response: _____

Incoming: -2

Sketch one continuous qualitative graph of balloon altitude, measured in meters, versus elapsed time using breakpoints $[0, 4, 6, 9, 13]$. In order, the stages are: Stage A: increases while steepening; Stage B: remains constant; Stage C: decreases while flattening; Stage D: increases at a constant rate. Also satisfy this global constraint: the final level is above the initial level. Label both axes. Exact vertical values are not specified, so show only the required direction, pace, and sign information.

Your response: _____

AP Precalculus

Function Representations and Average Rates of Change

Name: _____ Date: _____ Class: _____

Evaluate the supplied statement or method. Say whether it is correct, repair it if it is not, and verify the result exactly. Not every prompt contains an error.

A table gives $x = -5, f(x) = 35$; $x = 1, f(x) = ?$; $x = 5, f(x) = 54$. The average rate of change from $x = -5$ to $x = 1$ is 1. The table also claims an average rate of 3 from $x = 1$ to $x = 5$. After recovering the missing endpoint, decide whether all the information is consistent. Find the missing output and show the signed net-change equation. Student work/claim: The missing output is 41, so every supplied condition is satisfied. Identify the first invalid step or inference in the displayed work. Correct it and complete the original task.

Context/domain: precalculus

-5	35
1	_____
5	54

Diagnose the claim: 'A negative average rate means the function decreased throughout the interval.' Construct an exact one-unit-per-tick polyline counterexample on $[-3, 4]$ with endpoints $(-3, 13)$ and $(4, 8)$, and verify both its average rate and contradictory interior behavior. Student work/claim: A negative average rate means the function decreased throughout the interval. Identify the first invalid step or inference in the displayed work. Correct it and complete the original task.

Context/domain: precalculus

-3	13
4	8

Function Representations and Average Rates of Change

Full Worked Solutions - excerpt

Worked example

Problem. Let $f(x) = kx^2 + 2x$ for real k . Its average rate on $[1, 4]$ is 12. Determine k .

Answer. 2

Explanation and check.

The average rate is $k(1 + 4) + 2 = 5k + 2$. Thus $5k + 2 = 12$ and $k = 2$.

Worked example

Problem. For $f(x) = x^3 - x$ and $a > 0$, simplify the average rate on $[-a, a]$. Explain which symmetry is used.

Answer. $a^2 - 1$

Explanation and check.

The odd function has $f(-a) = -f(a)$. The quotient is $2(a^3 - a\frac{1}{2a}) = a^2 - 1$.

AP Precalculus
Comparing Average Rates of Change

Comparing Average Rates of Change | APPC-U01-P03

96 problems · Four activity formats

01	Answer Bank Challenge	24 tasks
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Topic focus

Across 96 tasks this topic asks for family with difference evidence, secant, interior comparison, curvature explanation, simplified rule in s, concavity and signed interval changes, secant rates, midpoint comparison, diagnosis and missing output or incompatibility proof.

8 PDFs and a README; 75 buyer pages.

AP Precalculus

Comparing Average Rates of Change

Name: _____ Date: _____ Class: _____

Answer each question and record the matching bank letter. Give exact values. Give the whole requested response, including any reasoning the question asks for.

For $f(x) = -x + 29$, derive the average rate of change on $[s, s + 3]$ as a function of s . Then state what the rule shows about linear versus quadratic change.

Bank label: _____

For the unknown quadratic $f(x) = ax^2 + bx + c$, two width-2 secants begin at $x = -2$ and $x = 0$ and have rates 2 and -6 , respectively. Also $f(-1) = 6$. Recover the coefficients supported by these constraints.

Bank label: _____

A function is declared linear on the equally spaced inputs in this exact table: $x = -2, y = -19$; $x = -1, y = -16$; $x = 0, y = ?$; $x = 1, y = -10$; $x = 2, y = -5$. Find the missing output if the declaration is consistent; otherwise explain why no value can make all entries fit.

Required output: missing output or incompatibility proof

x	y
-2	-19
-1	-16
0	_____
1	-10
2	-5

Bank label: _____

For $f(x) = x^2 + 4x + 17$, derive the average rate of change on $[s, s + 4]$ as a function of s . Then state what the rule shows about linear versus quadratic change.

Bank label: _____

AP Precalculus

Comparing Average Rates of Change

Name: _____ Date: _____ Class: _____

Answer each question and show your reasoning in the workspace. Give exact values rather than decimals unless the question supplies a decimal. Give the whole requested response, including any reasoning the question asks for.

For $f(x) = 3x^2 - 2x - 1$, derive the average rate of change on $[s, s + 3]$ as a function of s . Then state what the rule shows about linear versus quadratic change.

For $f(x) = -2x^2 - 3x - 4$, derive the average rate of change on $[s, s + 2]$ as a function of s . Then state what the rule shows about linear versus quadratic change.

For $f(x) = -2x^2 - 4x + 20$, derive the average rate of change on $[s, s + 5]$ as a function of s . Then state what the rule shows about linear versus quadratic change.

A model is known to be linear, quadratic, or outside those two families. Its exact samples are $x = -2, y = 12$; $x = 1, y = 12$; $x = 4, y = 12$; $x = 7, y = 12$; $x = 10, y = 12$. Identify the consistent family and cite the decisive difference pattern.

Required output: family with difference evidence

x	y
-2	12
1	12
4	12
7	12
10	12

AP Precalculus

Comparing Average Rates of Change

Name: _____ Date: _____ Class: _____

Begin at START. Answer the card, then find the matching final answer at the top of another card. Use the recording sheet for your reasoning. Visit each card once and continue to FINISH.

START

On $[-2, 3]$, $L(x) = -x + 6$ and $Q(x) = L(x) - 2(x + 2)(x - 3)$. Verify that their endpoint secant rates agree, compare $L(0)$ and $Q(0)$, and use curvature to explain the interior difference.

Your response: _____

Incoming: Both endpoint rates are -1 ; $L(0) = 6$ and $Q(0) = 18$. Q is concave down.

The inputs are not equally spaced in the exact table $(-1, 17)$; $(1, 17)$; $(4, 47)$; $(5, 65)$. Normalize every output change by its actual width, attach each rate to the interval midpoint, and test the quadratic requirement that those midpoint-rate pairs lie on a line.

Required output: secant rates, midpoint comparison, diagnosis

x	y
-1	17
1	17
4	47
5	65

Your response: _____

Incoming: Rates: 0, 10, 18; midpoints: $0, \frac{5}{2}, \frac{9}{2}$. The evidence is consistent with a quadratic.

For the unknown quadratic $f(x) = ax^2 + bx + c$, two width-1 secants begin at $x = -3$ and $x = -1$ and have rates -11 and -3 , respectively. No output value is supplied. Recover the coefficients supported by these constraints.

Your response: _____

Incoming: $a = 2$ and $b = -1$, while c is undetermined without an output anchor.

The inputs are not equally spaced in the exact table $(2, -2)$; $(3, -15)$; $(6, -78)$; $(10, -218)$. Normalize every output change by its actual width, attach each rate to the interval midpoint, and test the quadratic requirement that those midpoint-rate pairs lie on a line.

Required output: secant rates, midpoint comparison, diagnosis

x	y
2	-2
3	-15
6	-78
10	-218

Your response: _____

AP Precalculus

Comparing Average Rates of Change

Name: _____ Date: _____ Class: _____

Evaluate the supplied statement or method. Say whether it is correct, repair it if it is not, and verify the result exactly. Not every prompt contains an error.

Use the exact equally spaced table and the stated candidate families. A student reports slope 5 because successive outputs differ by 5. Identify the invalid inference and give the corrected conclusion supported by the exact data.

Required output: family with difference evidence

x	y
−4	0
−2	5
0	10
2	15
4	20

Use the exact equally spaced table and the stated candidate families. A student insists that a straight-line pattern is a nondegenerate quadratic because its second differences are constant. Identify the invalid inference and give the corrected conclusion supported by the exact data.

Required output: family with difference evidence

x	y
−3	−4
−2	−3
−1	−2
0	−1
1	0

Comparing Average Rates of Change

Full Worked Solutions - excerpt

Worked example

Problem. For $f(x) = x^2 + 4x + 17$, derive the average rate of change on $[s, s + 4]$ as a function of s . Then state what the rule shows about linear versus quadratic change.

Answer. $R(s) = 2s + 8$; it increases with interval location.

Explanation and check.

The endpoint change factors as $4[2s + 8]$. Dividing by the nonzero width 4 gives $R(s) = 2s + 8$. Thus the secant rate increases with interval location.

Worked example

Problem. For $f(x) = 3x^2 + x + 35$, derive the average rate of change on $[s, s + 5]$ as a function of s . Then state what the rule shows about linear versus quadratic change.

Answer. $R(s) = 6s + 16$; it increases with interval location.

Explanation and check.

The endpoint change factors as $5[6s + 16]$. Dividing by the nonzero width 5 gives $R(s) = 6s + 16$. Thus the secant rate increases with interval location.